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JPRS L/9400

18 November 1980

East Europe Report

SCIENTIFIC AFFAIRS

(FOUO 10/80)

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CZECHOSLOVAKIA

CSSR COMMUNICATIONS ANALYSIS 1960 TO 1978

Prague PTT REVUE in Czech No 4, Jul-Aug 80 pp 118-121

[Article by Engr Jaroslav Kriz and Engr Otto Svach, CSc, Communications Research Institute, Prague: "General Characterization of Developments of the Communications Branch"]

[Text] In connection with preparations for the Seventh Five-Year Plan an issue comes to the fore: the question of evaluating current developments in communications as a starting base for considering the possibilities of continuing development in communications at a comparable pace in the future. This article represents a summary analysis of the communications branch for the period 1960 to 1978 and a comparison of basic technical economic indexes with selected industrially developed countries.

The task of communications is to provide communications services corresponding in extent and quality to the requirements of a developed socialist society in the areas of mail, postal newspaper service, telecommunications and radio communications. The basic measure of the proper functioning of communications in society is the number of services provided and their quality, that is, completeness, readiness, accessibility, speed, regularity, accuracy and reliability.

Demand for communications services is constantly increasing, consistent with the rising level of social division of labor and the overall development of the national economy, the production of automated information systems and the rising living and cultural standards of the population. For communications to be able to carry out their functions reliably and well, especially in the area of transmission of information for management needs, they must develop in accordance with world practices in advance of other branches of the national economy. This is particularly true of telecommunications development.

Communications are gradually assuming a greater role in the Czechoslovak national economy, even though not yet sufficient to meet the needs of the Czechoslovak national economy in this period of scientific-technical revolution. Whereas in 1960 communications represented 0.67 percent of the formation of social production, in 1978 this had already increased to 0.91 percent, and the proportion of fixed assets in communications increased from 0.68 percent of total fixed assets in the national economy in 1960 to 1.30 percent in 1978. The proportion of workers in communications was 1.2 percent of all workers in the national economy in 1960 and 1.5 percent in 1978.

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Total output in communications in terms of 1977 costs rose from Kcs 3 billion to Kcs 9 billion, which represents a threefold increase. The value of fixed assets in 1977 costs rose from Kcs 8.3 billion in 1960 to Kcs 29.2 billion in 1978, a 3.5-fold increase, and the number of workers increased in the same period from 75,000 to 112,000, or approximately 1.5-fold.

The development of communications in the period 1960 to 1978 was basically efficient. Actual costs rose more slowly than communications output which resulted in a substantial growth in profits--from Kcs 0.1 billion in 1960 to Kcs 1.74 billion in 1978 (in 1977 costs). Labor productivity of communications workers increased in comparable costs during the period under discussion by more than 100 percent, and average wages during this period increased about 50 percent.

Providing communications services, especially in telecommunications and radio communications, requires more and more fixed assets and more costly ones, which is evident also in the increased value of equipment per communications worker. Supplying workers with fixed assets rose from Kcs 92,500 in 1960 to Kcs 261,000 in 1978 (in 1977 costs), thus approximately threefold. The efficacy of fixed assets during this period decreased from Kcs 0.361 per koruna of fixed assets in 1960 to Kcs 0.308 in 1978, or a reduction of about 15 percent. This reduction in efficacy was due particularly to the increased value of fixed assets for the same unit of equipment (for example, one service line for a local public exchange costs approximately three times as much for a second generation exchange as it did for a first generation exchange).

The development of communications proceeded at approximately the same rate as did that of the national economy as a whole (in relation to development of social production). Many branches, however, developed at a faster pace than communications. These were, in particular, the branches of fuel processing, electricity production, iron metallurgy, the chemical, coking and rubber industries, engineering and the metal working industry, production of glass, china and ceramics and the building industry. For communications to achieve the required lead ahead of the other branches of the national economy so that they can fulfill their function to the required extent and quality, it is necessary to invest in communications, according to our calculations and in comparison with international developments, about 3 percent of total investments in the national economy, whereas in the period under discussion this came to less than 2 percent of total investments.

Communications in Czechoslovakia are operating with equipment that is for the most part technically obsolete. Incorporating new technology into communications operations is, compared with world trends, very slow. This state of affairs is partly the result of delayed introduction of new products by our industry, especially GR Tesla enterprises; of inadequate capacities, especially in cable production; and the small amount of funds allocated to communications for the importation of modern equipment.

Great demands are made on communications workers because of high requirements for communications services and low technical standards. In view of their specialty, the mails and the postal newspaper service especially, have a considerable proportion of the operational and service employees (in communications about 60 percent of the workers, in the entire national economy about 14 percent). Likewise, communications employ a higher proportion of women of the total number of workers than do other branches of the national economy--62 percent compared with 48 percent. Communications have about a three times lower proportion of workers with advanced education than do other branches of the national economy (about 2 percent of all communications workers), but on the other hand, a three times higher proportion of workers with a full general secondary education (about 10 percent of the total number of communications workers).

This structure of communications workers no longer meets the increased demands, especially because of technical developments, required for higher quality of output and management.

The disparate employee structure shows up also in a wage evaluation. Even though the growth of average wages in communications during the period under discussion developed at approximately the same pace as the growth of average wages in the national economy as a whole, the amount of average wages in communications remains substantially below the average of the whole national economy (in communications the average wage is 10 percent lower). Of 43 branches of the national economy, communications are in 34th place; from 1960 to 1978 they fell one place when agriculture surpassed them.

The low wage level is especially evident in the category of operational and clerical workers where, together with certain assignments in a number of communications occupations (heavy loads, working in uncovered areas, work schedules different from regular shifts in other branches, etc) there is a negative effect on stability of personnel and thus also on the level of quality of communications services, especially in the postal service and PNS [Postal Newspaper Subscription Service] where a greater number of workers is also employed for a fixed period (pensioners, students) than in other branches of the national economy (in the postal service and PNS about 12 percent of the whole number of workers, in the national economy about 8.7 percent).

Development of the Postal Service and PNS from 1960 to 1978

In the postal service the amount of letter mail increased 1.4-fold from 1960 to 1978. The number of parcels and insured mail remained practically the same throughout the whole period. The number of deposits and payments increased about 1.5-fold, while the amount of money which the postal service handles increased about fivefold. The postal system of payments has been growing recently at the rate of 4 percent annually.

The number of post offices increased about 7 percent in the period under discussion. The number of inhabitants per post office remained practically unchanged throughout the entire period and consists of about 2,900 inhabitants. Comparing this index on an international scale shows that the situation is markedly better only in Norway, Switzerland and the GDR, where there are about 1,250 to 1,900 inhabitants per post office. In most countries the situation is about the same as here.

The number of letters, newspapers and periodicals subscribed to by mail per inhabitant is the same in a number of countries as it is here, about 165 pieces per inhabitant annually. This figure is about 50 percent higher in Belgium, Switzerland and Holland; in the United States the number of items of mail per inhabitant is 2-1/4 times that of the CSSR.

The speed of mail delivery in the CSSR is unsatisfactory. In 1978 about 85 percent of items mailed were delivered the day after mailing, about 9.5 percent were received the second day after, about 4 percent the third day and about 1.5 percent the fourth day or later. This is due especially to a shortage of workers and a low level of mechanized operations.

The system of cash payments provided by the post office is widespread in the CSSR. During the Third Five-Year Plan communications took over the provision of a new service--centered on collections.

Czechoslovakia leads the world in the number of postal money orders per inhabitant. This is a negative status since it requires a considerable amount of human labor and is especially affected by inadequate systems of noncash payment for the population.

Working procedures in the postal sector of the CSSR are characterized by little technical equipment with a preponderance of human labor often carried out in unattractive conditions. There is generally little mechanization of work at post office counters, for instance bill and coin counters, stamping and binding machines, metering machines, etc. Rural delivery of letters and parcel post by motor is continuing; this was begun during the Fourth Five-Year Plan.

In the first half of 1978 parts of an automated link for processing letter mail were put into test operations in Prague and Bratislava--sorting, filing and stamping machines. Also that year the development of semiautomatic classifying machine for processing letters was completed in cooperation with the GDR. In most developed countries this equipment is already extensively employed because it eliminates tiresome and monotonous human labor.

Throughout the postal sector, and especially in mail transportation, buildings are antiquated and transportation facilities are in short supply and marked with a high incidence of breakdowns.

In the postal newspaper service the total number of newspapers and periodicals delivered to subscribers and other patrons has increased 1.5-fold from 1960 to 1978 and has reached almost 2 billion copies. This is about 140 copies per resident annually. A greater number of copies per inhabitant was recorded only in the GDR (180 copies) and the USSR (160 copies). In the other socialist countries this index is lower.

In this sector, too, most of the operations so far are performed manually. In 1978 two new buildings for mailing printed matter were put into test operation in Prague and Bratislava as the first to be equipped with modern mechanized facilities with computer technology.

Development of Telecommunications 1960 to 1978

In this sector are concentrated the requirements of socialist society for the development of telephone, telegraph and teletype operations, for data transmission and for wire broadcasting.

In telephone operations the process of automation of local telephone communications continued in the period from 1960 to 1978. In 1960 about 60 percent of local exchanges were automated, in 1978 there still remained about 2.7 percent or 46 local areas with manual operations, while the proportion of telephones connected to local manual exchanges is 1.6 percent. In almost all capitalist states automation of local operations is fully completed.

At the end of 1978, 133 central telephone areas (or 54.5 percent) were fully automated, 97 central telephone areas (or 40 percent) were partially automated and 14 are still exclusively manually operated. In 1960, 4 central areas were fully automated and 20 were partially automated. Within the CSSR, automation is not proceeding uniformly; the CSR is lagging behind the SSR. Whereas 66 percent of central telephone areas are automated in the SSR, only 49 percent are currently automated in the CSR.

In a number of European and non-European capitalist countries there is full automation of long-distance and international operations (Sweden, Austria, Switzerland, the FRG, the United States, and Japan) and many countries are approaching this status. Of the socialist countries and GDR has the highest level of automated long-distance operations (about 90 percent); the USSR has approximately the same percentage of automation as we have; the other socialist countries have a lower proportion of automated long-distance operations. But most are proceeding with automation faster than we are.

The number of connections with automatic long-distance operations has been steadily increasing in the CSSR. By the end of 1978 automatic long-distance operations were being conducted in 844 one-way connections. This is largely a temporary arrangement: after construction of tandem exchanges and automation of central areas they will proceed to area automation. The establishment of three tandem exchanges in Banska Bystrica, Ceske Budejovice and Liberec in 1978 makes it possible for eight central areas to have automatic communications.

In 1978, 70 percent of long-distance calls were automated; in 1965 this was only 10 percent. Automatic long-distance communications began in 1960.

In international telephone communications there are automatic connections with 20 countries, three of which are only with the capitals. In 1978, 83 percent of international calls were automatic; in 1975 this was 58.5 percent. In 1960 international communications were conducted only manually.

From 1960 to 1978 the total number of telephones increased from 1,016,000 to 2,981,000, which represents approximately a three-fold increase. Of this the number of main telephone stations connected to public telephone exchanges increased 3-1/2-fold from 1960 to 1978 (441,000 to 1,578,000 stations). The greatest increase in this period was in home telephones whose number increased about eightfold, from 125,000 in 1960 to 1,014,000 in 1978.

Even though the installation of apartment telephones was given priority in the period under study, about 50,000 of these were installed annually with an average of about 115,000 apartments becoming available annually. With respect to the proportion of main telephone stations connected to public exchanges and extension telephones connected to branch exchanges the ratio in the CSSR is 3:2.

The building of local telephone exchanges, however, has not kept pace with the expansion of telephone service which results in the depletion of essential technical resources. For this reason in particular the number of unsatisfied applicants for installation or transfer of telephones increased in the period 1960 to 1978. In 1960, 47,000 telephone applications were not taken care of, in 1978 this had risen to 565,000 unfilled applications for telephones, with an average installation rate of 110,000 telephones annually.

The density of telephones per 100 inhabitants reached 19.60 in 1978 compared with 7.42 in 1960. The density of main telephone stations reached 9.64 in 1978 compared with 2.50 in 1960.

On an international scale, the CSSR placed 22nd in the world index of telephones, whereas in 1960 it was in 16th place worldwide. Thus it fell six places during the period under study. Almost all West European states as well as the United States, Canada, Japan and Australia have a higher density. Of these the United States and Sweden have a density about 3.7-fold higher; in the FRG, Belgium, Holland and Norway it is about two times higher. The CSSR has the highest telephone density among the socialist countries: about 15 percent higher than the GDR, and 2 to 2-1/2 times higher than in the MLR [Hungarian People's Republic], the PLR [Polish People's Republic] and the USSR. Of 5 million homes in the CSSR, approximately 1 million have telephone connections, while some 80 percent are without telephones. In developed capitalist countries about 75 to 80 percent of homes are equipped with telephones; in Sweden the figure is 100 percent.

In the area of telephone communications technical standards are not up to required levels. Almost 95 percent of main telephone stations are still connected to a first generation exchange, especially the P51 step-by-step selector system which makes greater working and material demands on maintenance and space than later generation exchanges. The introduction of second generation exchanges--with crossbar switches from Tesla national enterprise--began only in the Fifth Five-Year Plan. In the course of the Sixth Five-Year Plan test operations began with one junction exchange and five third-generation satellite exchanges with programmed control. The situation is better in private branch exchanges where 10 percent of the exchanges are already second generation with one-fourth of the connected branches.

In transmission technology the first generation electron tube system still prevail. They are less reliable and make greater demands on maintenance, space and electricity than later generation systems equipped with transistors or integrated elements.

The quality of telephone service also reflects the insufficient number of long-distance circuits and the small number of lines in big city networks which have not been extended to keep up with increasing operations. The result is overloading of automatic connections which leads to repeated calling and often even inability to get through at all.

In telegraph and teletype communications there was a marked increase in the number of participating teletype stations as well as teletype connections during the period under discussion. The number of teletype stations was 7-1/2 times higher in 1978 than in 1960 and came to 570 teletype stations per million inhabitants. In a worldwide comparison of this index in 1976 we ranked behind all the west European states and the United States, Japan and even behind the GDR and Hungary. For example, Belgium, Denmark, Sweden, Norway and Holland have 3 times as many teletype stations as the CSSR; the FRG and Austria have 4 times as many and Switzerland 7 times.

From 1965 to 1978 the number of unfilled teletype applications has remained at about the same level--about 1,000--with an average of 400 teletype stations set up annually. This situation came about recently largely because of inadequate supplies of teleprinters which are exported to a considerable extent.

The number of telegrams delivered in 1978 was approximately 1,000 telegrams per 1,000 inhabitants (a growth of about 20 percent over 1960). This number is 2 to 5 times more than the figure for this index in West European countries and the GDR, Poland and Romania. Only Bulgaria, and the USSR show a greater number of telegrams per 1,000 inhabitants. Public telegraph service is generally stagnating and its further development depends on increasing the efficiency of its present state. In the Sixth Five-Year Plan 10 kraj gentex stations were linked up in international communications with the USSR, Hungary, FRG and Austria.

Requirements for data transmission are at the present time provided by Czechoslovak communications. Technical resources, however, preclude the establishment of data networks. The extent of this service here is very much smaller than in all West European countries and the GDR and Hungary. Whereas here there is 1 terminal for data transmission per 10,000 inhabitants this index is about 20 times higher in Switzerland, 17 times higher in Great Britain, 15 times higher in the FRG, about 10 times higher in Denmark and France and about 1-1/2 to 2 times higher in the GDR and Hungary. The small amount of data transmission service here is due to the low level of electronics use throughout our national economy.

The number of participants in wire broadcasting increased 1-1/2 times in 1970 over 1960 with 4.5 participants per 100 inhabitants. Since 1970 the number of participants in wire broadcasting has been stagnating. A higher number of wire broadcasting participants is recorded in the USSR (about 5 times as many) while in the other socialist states this index is lower.

In the telecommunication sector the CSSR has not yet developed facilities for transmitting photographs and documents (facsimile, phototelegraphy, documentary and image telegraphy). In the west European states and in the USSR this service is well developed. It serves to transmit rapidly and flexibly illustrative statistical information on the telephone network as well as for transmission of news matter for the use of press publishers.

Radio-Communications Development 1960 to 1978

In the radio-communications sector Czechoslovak communications provide the technical facilities for radio and television transmission and radio relay communications.

The number of radio transmitters increased 2-1/2 times from 1960 to 1978. The output of the transmitters also increased: beginning with modernization of transmission technology for medium and long waves with high performance and high gain antenna systems we now have almost all of our territory (96 percent) covered by radio transmission. Total transmitter output on medium waves per km^2 of CSSR territory is 32 kw. The FRG, Bulgaria and Switzerland have higher output, whereas other countries have a lower output per km^2.

For UHF broadcasting a tri-program transmitter network is partially built and its high quality UHF signal covers about 75 percent of the CSSR. Total output of UHF transmitters per km^2 is about 7 kw in the CSSR. West European and certain socialist states (except the Romania, Hungary and Bulgaria) have a higher index than this.

The number of registered radio receivers increased during the period under discussion only slightly (about 5 percent). In 1978 there were 265 radio receivers per 1,000 inhabitants. This number is lower than in West European countries and in most socialist countries by approximately 10 to 20 percent.

The number of television transmitters for the first program increased twofold in the years 1960 to 1978 when the network of these transmitters was completed. During this period there were also built 29 transmitters for the second TV program, which was not transmitted in 1960, and also about 850 television converters which provide dissemination of TV programs over almost the entire territory of the CSSR. In 1978 first program transmissions covered almost 95 percent of CSSR territory including 98 percent of the population. Transmission of the second program covered about 58 percent of the country and 66 percent of the population.

Part of the first TV program transmitters were modernized, bringing color transmission to 75 percent of the territory. The TV transmitters of the second program provide full color transmission.

TV transmitters do not meet world standards with respect to rate of failure, stability of parameters and ease of maintenance.

The number of registered television receivers increased 13-fold from 1960 to 1978 and reached 250 permits per 1,000 inhabitants. On an international scale, the CSSR is in 17th place worldwide. There are 10 to 20 percent more TV sets per 1,000 inhabitants in Belgium, Holland, France, Switzerland, the GDR, FRG and Finland and 40 to 70 percent more in Denmark, Sweden, Canada, Great Britain and the United States.

The radio relay network was not started until after 1960. It provides part of the international connections, the connection between tandem telephone exchanges and serves to transmit TV signals. It is also used for the telephone network. A considerable portion of the equipment is still fitted with electron tubes. They are gradually changing to equipment with semiconductors which are smaller in size and use less energy. We have not yet begun the transition to integrated components, digital systems and systems with pulse modulation, all of which are in use in the developed countries.

In 1974, under the Intersputnik program, a surface satellite station with television and telephone sheath was put into operation.

In the radio-communications sector the CSSR does not yet have a system of public radio-telephone communications permitting direct connection with mobile stations on the telephone network. This service is widespread in the West European countries and the United States. The United States has attained a density of 23 stations per 1,000 inhabitants; Sweden, 12; Denmark, 8.5; the FRG and Norway 5.5, Finland and Great Britain 2.7 stations per 1,000 inhabitants.

Effectiveness of Communications in the National Economy

Communications and their performance effect the production process of the entire national economy, they affect the work procedures of other branches and are an element of efficiency which can make the whole process of management and coordination in the national economy more effective. This fact is projected in the effectiveness of communications in the national economy.

In the USSR, on the basis of findings in over 300 enterprises of all branches of the national economy, a methodology was prepared for calculating the national economic effectiveness of communications and determining the normative savings in time that are achieved in other branches of the national economy by more intensive development of communications services. This methodology and the norms were discussed by the Organization of Socialist Communications at the 11th session of ministers of communications of member states of OSS [Organization of Cooperation of Socialist Countries in the Field of Electrical and Postal Communications] in 1978.

The norms calculated on the basis of the research at the USSR enterprises assume that every newly installed telephone in the socialist sector saves 1.43 workers, every new teletype station saves 2.8 workers and one long-distance call saves 5 hours of work time in the production area in comparison with the use of other kinds of facilities to achieve one's objective, such as the postal service, telegrams and personal contacts on official trips.

According to this calculation, under conditions in the CSSR the savings in worker time achieved by a long-distance phone call is about 3 hours in view of the shorter distances.

With the use of these standards and by attaining an increase of 212,000 telephone stations and 7,000 teletype stations in the years between 1960 and 1978 and the accretion of 92.5 million long-distance phone calls in the production sphere during these years, the resulting relative labor savings in the national economy is about 460,000 persons, or the corresponding relative increase in labor productivity. On the average, between 1960 and 1978 one worker in the production sphere made a social product in the amount of Kcs 128,000. The relative labor savings in the national economy under these assumptions comes to about Kcs 59 billion worth of social production, which means that communications contributed about 13 percent of the total increase of social productivity of labor.

This demonstrates that the development of communications is very effective and is extremely important to the intensive development of the national economy.

In the period between 1960 to 1978 there was a marked improvement in communications services, especially in better radio and television transmission, greater automation of local telephone communications, automation of long-distance and international telephone communications, a substantial expansion of teletype connections, a further development of the postal newspaper service and the expansion and implementation of new services.

Because of inadequate facilities, and especially the lag in production of modern technology in our electronics and cable industry, there was no reduction during the period under study in the disproportion between the needs of society and the development of communications services, especially in providing telephone communications. In the overall index for telephony--the density of telephones per 100 residents--the CSSR has fallen during the period under study from 16th place in the world to 22nd.

In order to greatly improve and raise the level of communications services it is imperative to gradually modernize the technical base of communications and replace antiquated and wornout equipment with modern equipment which is less demanding of service, maintenance and energy, and thereby achieve higher reliability of local and long-distance telecommunications.

Scientific-technical developments provide conditions favorable to the improvement of communications facilities. In particular, development of the component base (integrated circuits, new memory technology, etc.) will permit achieving higher reliability and more accurate troublefree functioning, and consequently also diminishing costs and increasing efficiency. Greater use of carrier band facilities, light transmission, radio relay communications, satellite systems and other means will greatly increase the capacity of communications channels. Systems with time divisions working on digital principles permit the production of integrated communications networks that are technically and economically more advantageous. The use of computers permits automated control of the technological communications process. This process, however, is not simple, especially in telecommunications, because the new technology must be compatible with the production of complicated integrated units and calls for considerable outlays. The basic proviso for continued development of communications, however, is for our production enterprises to rapidly set about and proceed with the production of modern technology.

Another basic factor which underlines the necessity for rapid development of communications is the growing need for communications services. In view of the increasing volume of information for processing and in view of the rise in cultural standards and the expansion of automated control and production it is estimated that in developed capitalist states almost 70 percent of the workforce already works more with information than with physical objects. This tendency is definitely beginning to show up also in socialist countries as expressed in the constantly growing demand for services in the sector of distributing reports on the part of state agencies as well as economic organizations and the population. Necessary because of the limiting economic factors, this requirement is also needed for other reasons, especially:

--intensifying the socialist economic integration of CEMA member states and the process of drawing their economies closer together;

--reinforcing and improving the management and planning of social processes and the consequent formation of information systems by state as well as economic organizations, as the result of growing automation of management processess;

--expanding politico-ideological work of the party and state, and improving the socialist educational system;

--improving systems for the security and defense of the country; and

--developing and changing the quality of the socialist way of life of the population.

The impact of developments in communications shows up distinctly among users of communications with a definite effect on increasing labor productivity in industry in the building industries and agriculture. This contribution of communications to the development of socialist efficiency is especially important in this period of intensive development of the national economy. Communications can make a greater contribution to efficient development especially when communications services are consistent with the structure and extent of society's needs in the future. This, however, calls for producing conditions that accelerate the development of communications in advance of the other branches of the national economy.

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CONFERENCE TREATS CURRENT, FUTURE DEVELOPMENTS IN OPTICAL COMMUNICATIONS

Prague SLABOPROUDY OBZOR in Czech No 8, Aug 80, pp 411-413

[Article by Eng Miroslav Jedlicka: "Optical Communications '80"]

[Text] From 18 to 20 March 1980 the Czech Central Committee of the Electrical Engineering Society, Czechoslovak Scientific and Technical Society, TESLA-VUST [A.S. Popov Research Institute for Communications Engineering] and the Prague House of Engineering held the Second National Seminar on Problems of Optical Communications. The seminar was held in Prague and was intended to acquaint participants from various organizations in Czechoslovakia with work in this area both in Czechoslovakia and abroad, to provide information on the directions of future development in the field in this country, and to enable individual specialists to establish personal contacts.

The collection of abstracts issued at the seminar includes a total of 48 contributions, twice the number in the collection issued in 1978 on the occasion of the first seminar. An additional seven reports given at the seminar were not published in the collection. The papers can be divided into three large groups: reports giving primarily a general review of some part of the field and possibly indicating the future plans of the organizations in question or future prospects in Czechoslovakia; reports on methods, giving information on ways of preparing components and of measuring the characteristics of systems and components for optical communications; and summary reports giving the results of work by various Czechoslovak organizations.

The reports in the first group included the general report by K. Turek of TESLA-VUST on the current status and expected development of optical communications worldwide, which among other things characterized the current situation in terms of a spontaneous shift of interest to the spectral region from 1.3 to 1.5 micrometers, and in terms of the achievement of continuous radiation sources with output between 1 and 10 mW, with an expected lifetime of 100,000 hours, maximum attenuations of 0.25 dB/km in light guides, and detector transmission rates of from 2 to 140 Mb/sec.

The report by J. Gotz and J. Kyncel of SLS CSAV-VSCHT [Czechoslovak Academy of Sciences-College of Chemical Technology] was a review of the current state of the art and developmental trends in processes for the production of glass waveguides.

I. Huttel (TESLA-VUST) reported on semiconductor radiation sources for information transmission on fiber waveguides, i.e. fast luminescent diodes and semiconductor laser diodes. He stated in conclusion that the laboratories of TESLA-VUST are working on a fast luminescent diode and attached waveguide with an output of 100 microwatts to the fiber and with a response allowing transmission at the speed of third-order PCM; the TESLA Blatna national enterprise is to begin producing it in 1983. The widespread use of lasers in fiber optics was discussed by M. Pospisilova (SLS CSAV-VSCHT). The possibilities for using InP and the more complex InGaAsP quaternary compounds for sources and detectors in optoelectronics were treated by J. Kovac of the Electrical Engineering Faculty of SVST [Slovak Institute of Technology] in Bratislava.

Reviews of optical waveguides and connectors included the report of K. Kovats (VUKI [Research Institute of Cables and Insulators] Bratislava) on new findings with regard to optical cables and processes for producing them, the paper of K. Vrana of TESLA-VUST on components for waveguides (particularly connectors and couplers for the fiber-fiber junction), that of J. Voboril of the same institute on optimization of the coupling between the light source and the waveguide, which has been worked on by his unit for edge-radiating diodes and for lasers with stripe contact geometry, a paper by K. Novotny of the Electrical Engineering Faculty of CVUT on the filtering effects of waveguides with a leaky layer, and the paper of F. Osvald (URE [Institute of Radio Engineering and Electronics] CSAV) analyzing loss mechanisms and ways of measuring attenuation in fiber waveguides. V. Prosser, P. Hoschl and P. Hlidek of the Institute of Physics, Charles University, reported on the possibilities of making optoelectronic components from cadmium telluride and on their properties.

The single review paper on photon detectors suitable for optical communications systems was written by A. Burger and M. Sandera of TESLA-VUST. They dealt primarily with PIN silicon photoelectric diodes and silicon avalanche photodiodes, with brief mention of detectors for the infrared region and photomultipliers.

One group of reports dealt with various possibilities for utilization of optical communications; F. Korbar of Ceske Energeticke Zavody informed the seminar participants about utilization of optical communication for information collection in power installations. The same topic was dealt with by V. Klumpar of the Research Institute of Power Production. The main advantages of this application include immunity to the influence of external electromagnetic fields, electrical isolation of the transmitter and receiver when located in a medium with various potential differences, and conservation of copper. The current status and future prospects of telecommunications on optical fibers was dealt with by A. Klecka and K. Zaboj of TESLA-Research Institute of Communications. Data from the international organization CCITT indicate that dozens or even hundreds of organizations have taken part in putting systems using fiber information transmission into operation. These are at different levels of development, from experimental to commercial. Most were connections between municipal exchanges, and little long-distance traffic was attempted. The signals transmitted were primarily voice signals, less frequently data or image signals. On the basis of the experience accumulated an attempt has been made to standardize the parameters of optical fibers in order to proceed gradually to serious unification of optical fiber transmission of telecommunications signals.

The demands imposed on waveguides in cable transmission of television signals were discussed by J. Klima of the Research Institute of Communications in Banska Bystrica. It appears that this application will be indispensable in the future.

Optoelectronics is also utilized in production electronics. This interesting problem was discussed by a member of the Electrical Engineering Faculty of CVUT, T. Cetl, who, after analyzing the current world trend, called for the use of optoelectronic transmission in the production of transducers in order to improve their capabilities, and for production of power thyristors with direct or stage-by-stage control by means of waveguides.

The current situation and expected trends in the utilization of integrated optics was discussed by J. Schrofel of TESLA-VUST. The use of integrated optics in communications systems with fiber waveguides is expected to have the following advantages: a considerable decrease in dimensions and material use, improved operating parameters, better reliability and decreased energy requirements. Its use can be expected in complex optical devices for information transmission which require complicated handling of optical signals, such as long-distance large-capacity communication systems or multiterminal systems for data transmission in aircraft, ships and the like. Practical application of integrated optics is expected within the next few years.

The large group of reports on methods dealt primarily with measurement problems. A. Dockala (TESLA-VUST) reviewed measuring equipment for optical communications systems, primarily for measuring optical attenuation and dispersion of optical transmission paths. I. Kneppo of the Institute of Electrical Engineering, SAV [Slovak Academy of Sciences], reported on methods of measuring phase modulation values of optical radiation. Practical findings in measurement of the physical parameters of domestic and foreign-produced glass fibers were obtained by URE CSAV staff members B. Stadnik and Z. Hosek. They dealt with the measurement of attenuation, of the angular disperson of radiation exiting from the fiber, of losses resulting from bending of the glass, and of losses at fiber-fiber connections, and with assuring the optical quality of the glass. An interference method of measuring the refractive index of optical glasses which does not require any special adjustment of the sample was discussed by M. Mazanec of FJFI CVUT [Czech Institute of Technology]. V. Laichter (TESLA-VUST) reported on a variety of uses of the scanning electron microscope in production processes for optoelectronic parts, for example in measuring the surface structures specified for light generators. M. Jedlicka (TESLA-VUVET) showed how it is possible to use a standard light signal A to establish the absolute spectral sensitivity of linear photon detectors. The method is especially suitable for organizations which do not have precisely calibrated absolute radiometers. F. Lukes of the Solid State Physics Department, Faculty of Natural Sciences, UJEP [University of Jan Evangelista Purkyne], presented a brief review and evaluation of methods suitable for establishing the basic cladding parameters of light guides and optical fibers. Technological problems were discussed by members of SLS CSAV-VSCHT: M. Hayer dealt with the fundamental problems of drawing glass waveguides, J. Janusova dealt with the problem of purifying materials for the production of glass for fiber optics, G. Kuncova dealt with applications of polymers in optical communications systems, and F. Oswald (URE CSAV) presented a model of a device for drawing fibers and automatically monitoring the parameters of drawn fiber waveguides.

The summary reports included several which gave an excellent indication of the real current status of this field in Czechoslovakia. According to J. Dostal (TESLA-VUST), under the conditions in Czechoslovakia the need to use optical communication systems for data transmission over short distances is increasing. Accordingly TESLA-VUST has developed a laboratory model optical system for transmission of a nonrhythmical signal designed for RZ type pulses with a width of 250 ns and a repetition frequency of 0-2 MHz in order to acquire the necessary basic data. Tests indicated that the system is already suitable for some applications, but for general use it would require certain adjustments which will be the subject of future work. The same institute has developed an optical line for transmission of data between a control system and a machine tool, as reported by L. Sykorova. An FP86 infrared luminescent diode produced by TESLA-VUST was used as the light source, coupling about 10 microwatts into the optical fiber. The fiber was a TESLA-VUVET coated light guide with stepped refractive index (core diameter 100 micrometers, numerical aperture 0.58, attenuation 5-10 dB/meter, total length 1 meter), and a Polish BPY-30 PIN diode was connected to the output. The paper by K. Jurak, P. Florianek and J. Kalibera reported on two other optoelectronic lines developed by the Research Institute of Mathematical Machines. The lines are developed from components which will be available in the CEMA countries in the foreseeable future. They are expected to be used in computer equipment, for example in connecting digital computer peripherals to the main unit, or with measuring sensors in a disruptive environment. M. Hofman, M. Jiracek and V. Krupicka of the same organization investigated components of optical sensors, i.e. the configurations of the fibers, connectors and dividers which make it possible to construct a common optical path for several terminals. Dividers prepared by welding fibers with a spark discharge were studied experimentally, as were phenomena in so-called "mixing rods," which divide radiation evenly at the output. The following capabilities were achieved in Y-type connectors: average total loss 1.9 dB (minimum loss 0.4 dB); average signal loss in the weak branch 5.6 dB, with limiting theoretical value 3 dB.

Also included among optoelectronic components are focusing grid couplings which are particularly useful for planar waveguide systems. M. Miler and M. Skalsky of URE CSAV, who prepared and investigated such gratings, discussed the analysis of their properties by holographic methods and showed that the gratings when used on glass waveguides show stigmatic focusing of three-dimensional waves. J. Janta of the same organization dealt with determination of the refractive index profile of a nonhomogeneous waveguide and developed a method which he successfully tested on a $LiNbO_3$ diffusion waveguide. L. Simankova (TESLA-VUST) reported on the problem of acousto-optic components on dielectric substrates. A number of experiments performed at her organization indicated that acousto-optic interaction between an incident light wave and an acoustic surface wave is very effective in $LiNbO_3$ dielectric substrates, and that it can be used in various applications, e.g. in a planar modulator.

The anisotropic properties of the $LiNbO_3$ crystal can be exploited to create a coupler, the seminar was told by J. Ctyroky, URE CSAV, M. Cada (FEL CVUT) and J. Schrofel (TESLA VUST). The advantage of such a component is that in a planar arrangement it can effect coupling using only the properties of the substrate and waveguide, without intermediate structures.

In view of the prospective importance of $LiNbO_3$, a material which has been intensively studied, the question of stability of its refractive index as a function of illumination is gaining in importance. J. Cty:oky and J. Janta determined that the maximum output density which waveguides made of this material can withstand for several dozen minutes without noticeable optical damage is on the order of tens of watts per cm^2. The quality of these waveguides increases with the purity of the materials used.

The electromechanical and electro-optical properties of crystals of $LiNbO_3$ and $Bi_{12}GeO_{20}$ were measured by J. Zelenka (VSST Liberec). J. Nezval of URE CSAV discussed the analysis of waveguide systems with periodic structure made with a plane parallel dielectric coating.

Another group of summary reports dealt with the problem of radiation sources. L. Mista of the Natural Sciences Faculty of Palacky Uni ersity in Olomouc demonstrated the possible existence of light sources with anticorrelation properties (photon distribution narrower than the Poisson distribution typical of coherent radiation and variance less than zero), when the number of photons generated has a range below that for a perfectly stabilized laser. The causes of instability of optically pumped lasers were discussed by J. Pachmann of TESLA-VUST. He determined experimentally that fluctuation of the output of a $YAG:Nb^{3+}$ laser results primarily from fluctuations in the refining temperature of the YAG and a resulting variation in refractive index; it was possible to increase the stability markedly by suitable cooling.

Two reports dealt with the properties of electroluminescent diodes. L. Kucera, J. Machac and J. Misek of URE CSAV dealt with the transmission properties of electro luminescent sources, and L. Hudec, F. Machac and V. Kyslik of the Microelectronics Department, FEL CVUT, dealt with the important problem of fatigue and aging of light-emitting diodes. The properties of InP diodes prepared by diffusion or epitaxy by the Department of Electronics, EF SVST in Bratislava, which emit radiation with a wavelength of about 980 nm and have an average efficiency of 0.2, were described by P. Habovcik of the Department of Microelectronics, SVST.

Reports on radiation detectors included one by a group of workers from the Institute of Physics, Charles University, P. Hoschl, V. Prosser, N. M. Tuan and M. Vanecek, on detectors based on CdHgTe. Their maximum photoelectric sensitivity is between 3 and 12 micrometers. Their main use is expected in such areas as open-air optical communications at 10.6 microns (the output wavelength of the CO_2 laser). I. Benc, J. Kriz, J. Ladnar and J. Urbanec of TESLA VUVET reported the results of their work on an experimental PIN silicon photoelectric diode with a $2mm^2$ sensitive layer and a response time of less than 5 ns.

A process for preparing starting materials was dealt with in the paper by F. Tuma and V. Simacek of TESLA-VUST, which described the preparation and machining of solid $LiTaO_3$ monocrystals suitable for preparing chips of high structural quality for components based on the acousto-optic phenomenon. A further contribution from this group, by L. Pekarek and P. Paris of TESLA-VUST, discussed the preparation of the quasidielectric InP for infrared emitters and detectors and the study of precipitates of it by electron microanalysis. A method of preparing smooth monocrystalline layers of $Ga_{1-x}In_xAs$ ($0 < x < 0.25$ epitaxially from the gaseous state on monocrystalline GaAs substrates was discussed by J. Stejskal of TESLA VUST. The material was later used for preparation of detectors.

The problem of deflection of light beams was the topic of a paper by M. Klima (FEL CVUT) who designed a trichromatic acousto-optic deflector for television purposes, and of a paper by M. Kucera, J. Pistora and V. Parizek of the Institute of Physics, Charles University, who discussed the use of thin garnet layers for deflection.

Two basic reports dealing with the near-term future of the optical communications field in Czechoslovakia were presented by M. Chomat and B. Stadnik of URE CSAV and P. Klima of TESLA-VUST. The first report dealt with plans for basic research in optical communications and its association with the needs of technical and industrial work during the Seventh Five-Year Plan. The main research effort will be concentrated on components for optical communications systems operating in the 1.3 micron region. In addition to raising the level of technical knowledge, a search will be made for results which will find extensive utilization in technical work and industrial production. The technical part of the State Plan for Basic Research will be concentrated on the pivotal assignment under the heading "Electronics," in which three main tasks relevant to optical communications will be accomplished: investigation of semiconductor lasers intended for use as radiation sources emitting in the 1.3 micron range, primarily using semiconductor heterostructure layers consisting of quaternary compounds, along with associated work in planar and stripe waveguide structures; the investigation of glass waveguides oriented toward the preparation of multimode fibers with stepped and graded refractive index profiles; and finally, investigation of selected problems of integrated optics and problems of fast-response photon detectors using $A^{III}-B^{V}$ compounds.

The other report dealt with solution of the problem of optical communications in the next five-year period in the context of the State Plan for Development of Science and Technology. The solution is based, among other things, on the fact that analysis of social needs in Czechoslovakia has identified a current need for a simple transmission system for distances less than 300 meters, with a total scale of about 10,000 connections in 1985 and 30,000 in five years thereafter, as well as requirements for certain opto-electronic components (fibers, sources, optrons) for automation, regulation, calculating, measurement and instrumentation technology, for power production, for mastery of high-voltage equipment and the like. The purpose of the state research assignments in the Seventh Five-Year Plan is provision of the basic materials, components and modules for short-range opto-electronic communications, their introduction into production, and the production preparation of more demanding systems for telecommunications engineering and related applications, including the solution of selected problems of integrated optics. The approaches to performing the task include beginning the production of the basic monocrystalline materials GaAs and InP, light guide fibers and cables for short-range connections, infrared radiation sources and communications optrons, optical connectors, and components of modules for transmission of digital information with speeds up to 10 Mb/sec with an error figure of 10^{-9}.

The review report of C. Anderly of TESLA-VUST informed the seminar participants about developing international cooperation on normalization and standardization in fiber optics within the framework of the International Electrical Engineering Commission (IEC).

The organization of the Second National Seminar on Optical Communications was unquestionably of great usefulness. It became evident that in the course of 2 years the scientific and research base in Czechoslovakia has greatly expanded, dealing with optical communications from many necessary points of view, and that a number of specific results have been achieved, which may be a serious basis for considering which of the extensive range of opto-electronic components can be produced effectively in Czechoslovakia and which will need to be imported. It was confirmed that opto-electronic signal transmission is one of the extremely important areas in which the Czechoslovak electronics industry should achieve a level corresponding to the current worldwide state of the art, and thus gradually aid in raising the standards of both communications and important industrial products.

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CZECHOSLOVAKIA

NEW CSSR AUTOMATION AND COMPUTER TECHNOLOGY EXHIBITED

Prague TECHNICKY TYDENIK in Czech No 35, 2 Sep 80 p 11

[Report: "The Automation and Computer Technology Works, the Leader in Electronics"]

[Text] At this year's Engineering Fair in Brno, the Automation and Computer Technology Works is exhibiting over 100 products, nearly half of them in the nature of novelties. Yet, only seven products have been entered in the competition for the fair's gold medal. These are:

A computerized system for measuring rotating machinery;

The Consul 2712 (EC 9112) one-clerk station for preparing data on floppy disks;

The Aritma EC 5075 floppy-disk input/output unit;

The Autovoc system;

The Consul 2113 serial printer;

The KA 10 (EC 8540) system for data preparation; and

The Consul 259 11 electronic contactless alphanumeric keyboard.

Tests, Controls, Switches

The computerized system for measuring rotating machines (ASM-TS) was developed in cooperation with the electrical engineering faculties of the Czech Institute of Technology in Prague and of the Institute of Technology in Brno, with the Research Institute of Mathematical Machines, and with other enterprises of ZAVT [Automation and Computer Technology Works]. The system's final producer is the Industrial Automation Works of Cakovice.

With suitable software, the system serves to test electrical machines (induction, synchronous, traction motors, etc.), to measure the voltage, current, frequency, time, rpm and resistance of rotating machines. The system can be modified for technological process control in industry, for speeding up and improving the maintenance of communication paths and equipment in telecommunication, etc.

The system's application significantly improves labor productivity at measuring stations in R & D institutes, in the laboratories of large enterprises, and in control operations during production. It relieves skilled personnel of much routine work and makes the results of control more objective.

The ASM-TS is a two-level system. It is based on measuring stations, of which there can be as many as 16, connected to an ADT 4500 master control center.

The measuring stations have two branches. One, for slow measurements, consists of an M3T 300 intelligent terminal, of digital measuring instruments and a channel selector (they are controlled by an IMS 2 sixteen-bit parallel bus), and of adapting and final-control elements (these correct the output of the tested object's measured variable to the input of the measuring instrument or of the input modules in the unit for contact with the environment, and they serve to control and set the parameters of the measured and tested objects).

The other branch, for high-speed measurements, consists of an M3T 300 intelligent terminal, an LSP 100 unit for laboratory contact between the computer and the environment (this is a modular unit that permits two-way contact between the digital computer and the real environment, by means of input and output modules connected to a controller), and of adapting and final-control elements.

When necessary, various peripherals can be added to the measuring station (for example, a printer for control printouts of the measured data, a tape reader/punch unit, and a floppy-disk memory). The peripherals are connected to an M3T 300 intelligent terminal that controls the entire measuring station, assigns the tasks, records the readings and is itself able to do some processing at slow speed. For faster central processing, the intelligent terminal provides access to a master computer that may be located at a distance of 1 km.

The system's master computer is the ADT 4500 electronic control center. It has a processor with microprogrammable instructions whose word length is 16 bits; its immediate-access memory has a capacity of 32 words. It also has a casette/disk memory with a capacity of 2.5 Mbytes, a printer, an alphanumeric display, punched-tape peripherals, and a BAK coordinate plotter for continuous recording on paper of up to folio size.

The software of the ASM-TS is based on the ADT 4500 electronic control center's DOS III operating system, supplemented by a TCS program for controlling the network of terminals.

The programs for measuring tasks are in Basic language, but the measuring stations equipped with an M3T 300 intelligent terminal may use also symbolic-address Assembler language for greater speed.

The two-level system has the following capabilities:

Automatic acquisition of data from the measured object;

Preparation of these data and their storage in the system's external memories;

Transfer of data from several measuring stations, for processing by the faster ADT 4500 electronic control center;

Evaluation of the obtained data, including printouts of the measurement log and graphic plotting of the results;

Feedback control and adjustment of the measured and tested object's parameters.

Nonconventional, Creative Approach

The Consul 2712 (EC 9112) one-clerk station for preparing data on floppy disks incorporates the most advanced technology. It is based on a microcomputer that consists of a microprocessor and RAM and ROM memories. It is intended primarily for the acquisition and preparation of data at distributed locations. Similarly as the Consul 271 system, also this station is a part of JSEP [Unified System of lectronic Computers] and SMEP [System of Small Electronic Computers].

At the recent Zenit 1980 Fair in Ostrava, the Consul 2712 station was awarded a gold medal. It was the only product to win the special prize, offered by the ditors of Czechoslovak Radio's Youth Studio and of the journal VEDA A TECHNIKA MLADEZI, for the best exhibit in the field of electronics. The system was developed by the R & D base at Zbrojovka [Munitions Works] in Brno. Typical of this R & D base is a significant proportion of young members who have introduced a bold and nonconventional approach to their solutions.

With Floppy Disks

The Aritma EC 5075 floppy-disk input/output unit is the basic peripheral of the 3.5th generation of computers in the Unified System of Electronic Computers.

It is intended for the direct transfer of data from a floppy disk to the computer, and from the computer onto a floppy disk. In comparison with punched-card equipment, it fully replaces a card reader and punch connected on-line to the processor. The main parts of the equipment are an automatic floppy-disk changer, a disk module (EC 5074), and a control unit, including a buffer memory and channel section. The automatic floppy-disk changer can change up to 20 floppy disks without the operator's intervention. The cycle for changing a diskette, not including the read or write time, is about 5 seconds. The storage medium is the standard floppy disk on which information is recorded in 77 concentric tracks. Each track is divided into 26 sectors, and one sector always contains a block of fixed length. There are 128 bytes reserved for data in each block. The capacity of a track is 3328 bytes, and the capacity of the entire disk is 242,944 bytes, with two reserve tracks containing no data. In terms of capacity, one disk replaces 1900 punched cards. At a transmission rate of 2500 bits per second, it is possible to read up to 3600 blocks per minute, and to record up to 2200 blocks per minute. A single read/write head is used for recording, on the contact principle. Actual recording or reading occurs in the memory's mechanism. The EC 5075 can operate only with preinitialed diskettes, which means that control information must be recorded in advance on the floppy disk, in the specified format.

The built-in control unit processes the instructions from the computer's basic unit and controls transmission along the channel, as well as both automatic floppy-disk changers with the EC 5074 modules. It also communicates with the operator's pannel and the technician's pannel. The control unit includes a controller, channel section, control panel, technician's panel and power supply.

Autovoc System

The basic mission of the Autovoc system is to enable the drivers of motor vehicles to quickly summon first aid, the Public Security Forces or the emergency repair service. The system comprises an unlimited number of mobile transmitters installed in motor vehicles, pole-mounted emergency call boxes, a main exchange and branch exchange with dispatcher's stations, and supplementary equipment. Each pole-mounted emergency call box contains a telephone with three buttons, an antenna, and a flashing light signal. The mobile transmitters likewise are equipped with three buttons, for summoning the three types of emergency aid. Four pairs of cable provide communication between the pole-mounted emergency call boxes and the exchange. The described structure is based on the interaction of all these parts.

To the system it is feasible to add equipment with which it is possible to obtain centrally information about the road, traffic and weather conditions or fog on highways, and to transmit appropriate warnings by means of resettable traffic signs on the sections of highway where it is necessary to make repairs and regulate traffic.

Advanced Technical Parameters

The Consul 2113 serial printer meets the modern requirements placed on computer harware. It belongs in the successful line of Consul 211 serial printers that were awarded many diplomas, both at home and abroad. The

Consul 2113 printers significantly broaden the functional characteristics and performance of SMEP computers. Consistent modular design permits gradual upgrading of the individual functional units, without affecting the rest of the machine's design, and it also makes possible a new concept of servicing and repair strategy.

The Consul 2113 represents a transition to a higher generation, from electric typewriters with a speed of up to 12 characters per second, to printers with a speed of 150 characters per second. In conjunction with this, the functional characteristics of these machines are broader, their reliability is greater, and their maintenance and servicing are more simple.

Data Acquisition and Preparation

Aritma of Prague produces the KA 10 (EC 8540) system for data acquisition at the place and time of their generation. It also ensures the subsequent preparation of the data in the predetermined form, limiting or entirely eliminating the manual processing of the primary sources of information. This makes for higher labor productivity and the better utilization of computer systems, improving their operation.

In combination with a JSEP computer, a KA 10 system can comprehensively solve the tasks of a management information system for an enterprise or trust. The system's modular design allows any configuration necessary for solving the given circle of tasks. Simultaneously this concept permits flexible addition and expansion of peripherals, in accordance with the user's needs. The system consists of a central unit, and of equipment that forms a data-acquisition loop. The central unit contains a processor module, a disk module, and a digital module.

The processor module's basic function is to control the operation of the entire system, to perform operations with the data, and to work together with the system's other modules. The processor module is the basic module in any configuration. The number of disk modules (they are the basic element of the large-capacity external memory) and digital modules (intended for contact with the nvironment) can be selected in accordance with the system's planned applications.

The central unit is always equipped with an operator's pannel (it is connected directly to the processor module and serves to control the entire system), and with the desired number of serial printers, magnetic-tape units and card punches.

The data-acquisition loop consists of data-acquisition stations (the terminal devices are star-connected to them), a loop controller, and a cable.

The data-acquisition stations (there can be 16 such stations in a loop) operate as controllers of the connected terminal devices, and also as independent input/output units.

The data-acquisition loop's terminal devices are input units, identifying mark sensors, displays, and slow-speed printers. With the KA 10 (EC 8540) system it is possible to solve complex tasks in the most diverse branches of the economy.

Consul 259 11

As an input unit, the Consul 259 11 electronic contactless alphanumeric keyboard is intended for use with SMEP computers. The electronic contactless design offers high functional reliability and long service life. The fact that the keyboard's output code is programmed in PROM (ROM) circuits permits wide variability in coding, in accordance with the customer's requirements. The keyboard equipped with an IRPR interface has 78 keys arranged in five banks. Characters are assigned to the keys in accordance with the specifications of national norms. The keys are color-coded by function to provide better orientation for the operator. Black and blue keys in the basic keyboard field and white keys in the numerical part are only one of the possible code combinations, independently of the selected register. The other keys, in accordance with the type of keyboard, generate three to five different code combinations, depending on the selected register. Optical and acoustical signals considerably facilitate operation.

The keyboard is equipped with a special blocking circuit that operates when two or more keys are pressed simultaneously. This significantly reduces the possibility of error when writing on the electronic keyboard.

The Consul 259 11 electronic contactless keyboard consists of a supporting plate, logic board, contactless keys designed with integrated circuits, fasteners for the circuit boards and keys, an internal cable with a connector, and a two-part keyboard cover.

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